U.S. Election Assistance Commission

Voting System Testing and Certification

Everyone Counts, Inc.
Quality Assurance Audit Report

January 14, 2015

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Executive Summary

Everyone Counts, Inc. (E1C) is an EAC registered voting system manufacturer based in the San Diego, CA metropolitan area and has been registered with the U.S. Election Assistance Commission (EAC) since 2009. On September 16-17, 2014, the Election Assistance Commission conducted a quality assurance audit of E1C in order to collect sufficient data to assess the manufacturer's quality systems and their compliance with the quality assurance requirements of the EAC certification program and the *2005 Voluntary Voting System Guidelines.*

The quality assurance audit found that while E1C had very recently developed and incorporated a quality assurance manual into their company processes, the manual needs to be strengthened, fully implemented with the backing and support of senior management and backed up with internal procedures that would allow independent auditors to determine if E1C is actually meeting their stated quality goals.

This report provides 11 specific recommendations for E1C in order for the company to improve overall quality management and quality assurance and to bring their current process more in line with the intention of the requirements of VVSG Section 8. These recommendations are detailed in the Audit Recommendations Section of this report.

Introduction

On September 16-17, 2014, the Election Assistance Commission conducted a quality assurance audit of E1C at the company headquarters in San Diego, CA. Participating in the audit for EAC were Jessica Myers, Certification Program Specialist; Megan Dillon, Computer Engineer; Mark Skall, Technical Reviewer; and Tom Caddy, Technical Reviewer.

The quality assurance audit was performed pursuant to Section 2.3.1.4 and Section 8 of the EAC *Testing and Certification Program Manual* as well as Section 8 of the 2005 Voluntary Voting System Guidelines (VVSG).

This report, along with the attached appendices, documents the audit findings, conclusions and recommendations and will be forwarded to E1C and included as an attachment to the Everyone Counts eLect Voting Solution 4.0 Test Report in order to assist the manufacturer with meeting the requirements of VVSG Section 8 and improving their overall operations and quality control.

Purpose

The EAC conducted the audit because of concerns that arose during the TTA Meeting about the quality assurance practices of the manufacturer. Quality assurance audits are part of each TTA agreement and even though the TTA for E1C is not finalized at this point, it is a non-negotiable part of the agreement.

Scope

This audit was conducted in order to collect sufficient data to assess the manufacturer's quality systems, their compliance with the quality assurance requirements of Section 8 and the configuration management requirements of Section 9, Volume 1 of the *2005 Voluntary Voting System Guidelines* (VVSG), and to compare E1C quality practices to IT industry standard QA practices.

To accomplish the audit objectives noted above, the EAC:

- Met with E1C management and senior staff.
- Listened to briefings and participated in discussions regarding E1C management and quality systems.
- Reviewed documentation related to the E1C QA system.
- Use EAC Quality Audit Checklist to determine compliance.

Why Conduct a Quality Audit?

Quality assurance is often defined as a process-centered approach to ensuring that a company or organization is providing the best possible products or services to its customers. Quality assurance focuses on enhancing and improving the process that is used to create the product, rather than focusing on the product itself. Among the parts of the process that are considered in QA are planning, design, development, production and service.

Quality assurance demands a degree of detail in order to be fully implemented at every step. Planning, for example, could include determining specific levels of quality or measurable results that the organization wants to achieve. Checking could involve testing and other objective measurements to determine whether the goals were met, rather than mere subjective evaluation of quality. Acting could mean a total revision in the manufacturing process to correct a technical or cosmetic flaw or very small changes to improve efficiency or accuracy.

Quality assurance verifies that any product, regardless whether it is new or modified, is produced and offered with the best possible materials, in the most comprehensive way and with the highest standards. Quality assurance provides the mechanism to exceed customer expectations in a measurable and accountable process.

ISO 9000 is a family of standards published by ISO, the International Organization for Standardization, related to quality management systems and designed to help organizations ensure that they meet the needs of customers and other stakeholders while meeting statutory and regulatory requirements related to the product. ISO 9001 is a global quality management standard dealing with the requirements that organizations wishing to meet the standard must fulfill. As of 2011, more than a million organizations worldwide were certified to the ISO 9001 standard. While not a panacea for every quality related problem an organization may face, the principles of ISO 9001 have been the guiding force in organizational quality since the early 1990's.

ISO 9001 defines **quality** as something that can be determined by comparing a set of inherent characteristics with a set of requirements. If those inherent characteristics meet all requirements, high or excellent quality is achieved. If those characteristics do not meet all requirements, a low or poor level of quality is achieved. **Quality assurance** (QA) is defined as a set of activities intended to establish confidence that quality requirements will be met. QA is one part of quality management. A **quality management system** (QMS) is a set of interrelated or interacting elements that organizations use to direct and control how quality policies are implemented and quality objectives are achieved.

Finally, a **quality manual** documents an organization's quality management system (QMS). It can be a paper manual or an electronic manual. According to ISO 9001 section 4.2.2, a quality manual should:

- Define the scope of your QMS.
    - Explain reductions in the scope of your QMS.
    - Justify all exclusions (reductions in scope).
- Describe how your QMS processes interact.
- Document your quality procedures or refer to them.

While not requiring ISO 9001 certification from voting system manufacturers, the 2005 VVSG recognizes the importance of quality assurance in voting systems with the specific requirements related to quality contained in Section 8.

VVSG Section 8.1 defines the scope of QA.

> *"Quality assurance provides continuous confirmation that a voting system conforms with the Guidelines and to the requirements of state and local jurisdictions.* ***Quality assurance is a vendor function that is initiated prior to system development and continues throughout the maintenance life cycle of the voting system.*** (Emphasis added) *Quality assurance focuses on building quality into a voting system and reducing dependence on system tests at the end of the life cycle to detect deficiencies, thus helping ensure the system:*
>
> *• Meets stated requirements and objectives*
> *• Adheres to established standards and conventions*
> *• Functions consistently with related components and meets dependencies for use within the jurisdiction*
> *• Reflects all changes approved during its initial development, internal testing, national certification, and, if applicable, state certification processes."*

VVSG Section 8.2 defines the general requirements for quality assurance:

> *"The voting system vendor is responsible for designing and implementing a quality assurance program to ensure that the design, workmanship, and performance requirements are achieved in all delivered systems and components. At a minimum, this program shall:*
>
> *a. Include procedures for specifying, procuring, inspecting, accepting, and controlling parts and raw materials of the requisite quality*
>
> *b. Require the documentation of the hardware and software development process*
>
> *c. Identify and enforce all requirements for:*
> *i. In-process inspection and testing that the manufacturer deems necessary to ensure proper fabrication and assembly of hardware*
>
> *ii. Installation and operation of software and firmware*
>
> *d. Include plans and procedures for post-production environmental screening and acceptance testing*
>
> *e. Include a procedure for maintaining all data and records required to document and verify the quality inspections and tests."*

Because determinations of quality can often be subjective, the EAC uses the Quality Audit Checklist to focus auditors and to provide a general basis for determining if the manufacturer meets the quality requirements of the VVSG and the general principles of quality outlined in ISO 9001.

Current E1C Quality Assurance Processes

The formal QA process at E1C is a new development triggered by the commencement of the Everyone Counts eLect Voting Solution 4.0 test campaign and the TTA discussions between E1C and the EAC. This statement is reflective of the fact that the E1C Quality Assurance Manual 1.0 is dated August 11, 2014 and the current version, 1.4, is dated September 15, 2014.

E1C is a small company with approximately 50 full time equivalent employees, including the Chief Executive Officer. E1C is working toward implementing an Agile[1] project management system. They use JIRA[2] for bug tracking and tracking test cases, but only began implementing this system in July 2014. They use Chef[3], implemented 2 years ago, to manage deployed software and Mercurial[4], implemented 2 years ago, to control the recipes in Chef.

The QA manager is responsible for all QA duties and can halt items in testing, but does not have the overall authority to halt a software or product release and any decision to halt items can be overturned by the Director of Engineering and/or the Chief Operating Officer. This Chief Operating Officer of E1C is the only person with authority to halt the production, testing or release of a product.

Internal testing is conducted under the QA department who develop their own test cases. In some cases, software engineers will assist with development of test cases for QA. It was unclear how validation of the test cases is performed by E1C. It was also unclear how E1C determines pass/fail criteria for these test cases and auditors had some trouble determining that the test cases present covered every aspect of the system.

IT, QA and Engineering work together to manage JIRA. According to the organizational chart, QA falls under Engineering, so the QA Manager reports to the Director of Engineering. There does not appear to be a formal employee training program at this point, but employees are currently required to read the QA policy and sign off that they read and understand it.

E1C appears to have some of the requirements of a QA program built in to their development process and tools, but many of these are not formally documented in policy or procedure.

Audit Results

This section details the results of the quality audit by highlighting findings noted by the audit team in their quality audit checklist. The EAC quality audit checklist contains five major sections covering:

[1] Agile project management is an iterative and incremental method of managing design and development activities for a project or product. Agile software development is when software requirements, development and solutions evolve through collaboration between teams.
[2] JIRA is a bug tracking, issue tracking and project management software tool.
[3] Chef is a configuration management tool used to configure and maintain servers.
[4] Mercurial is a revision control tool for software developers.

- Organizational Quality Management System (1.0)
- Product Design and Development (2.0)
- Pre-Production Design and Development Testing (3.0)
- Identify and Control Nonconforming Products (4.0)
- Labeling (5.0)

1. *Organizational Quality Management System*
   - E1C does not have a separate division of quality responsibilities, but instead the QA Manager reports to the Director of Engineering. (1.2)
   - Since no separate QA unit exists at E1C, the QA manager alone does not have the authority to approve or reject designs, parts, components or finished products. This authority rests with the COO and the Director of Engineering can overturn a hold placed by the QA manager. (1.3)
   - The EAC could not locate and review a process for the review of production records or documentation. (1.4)
   - The Quality Manual does not contain the documents listed in this bulleted list, except the organizational chart and the policy statement. (1.6)
   - EAC could not clearly identify a procedure to trace finished products back through the production and quality control cycle. E1C has implemented new software development tools, bug tracking, test case tracking and other project management tools, so this may change in the future. (1.7)
   - Currently, E1C does not have a QA training program, but after lengthy discussion with EAC, the QA manager has a clear understanding of what this means and what EAC will be looking for in the future. (1.13)
   - A formal internal auditing function does not currently exist in the QA department. (1.15)

2. *Product Design and Development*
   - EAC could not locate and did not review adequate records of design reviews. (2.6)

3. *Pre-Production Design and Development Testing*
   - Some testing is done to validate compliance to requirements, but EAC could not get clear information on test case validation and pass/fail criteria. Additionally, test records are incomplete. (3.1)
   - Test methods are not currently traceable to system functional requirements or State/Federal certification requirements. E1C recently implemented new test management software, so this should be reviewed in a future audit. (3.2)
   - Testlink[5] records are incomplete, and in some cases, nonexistent. This may be remedied by software solutions E1C is currently implementing and integrating into their process. (3.3)

[5] Testlink is a web-based software that supports software quality assurance by enabling a user to manage test cases, test suites, test plans, and test projects.

- Test Records are missing items, including: pass/fail criteria, product IDs, and signatures. (3.4)
- Records do not contain sufficient information to permit repeatable tests. (3.5)
- EAC did not receive any information on how contractors test or how E1C handles 3rd party testing. (3.6)
- Records of testing appear to be incomplete. (3.7)

4. *Identifying and Controlling Nonconforming Products*
   - EAC was not provided with procedures to identify, evaluate and address nonconforming materials. (4.1)
   - It appears that, with the implementation of JIRA for bug tracking, some corrective actions and root causes are being identified, but these records are incomplete and there is not currently a procedure for developers to follow to make sure information is entered into JIRA completely. (4.2)
   - It was unclear to EAC how much information about nonconforming work is recorded by E1C. There is no procedure in place related to nonconforming work, so it is impossible to know how much and how frequently these items are recorded. (4.3)
   - EAC was not provided with any information about a customer notification process for nonconforming work, products or anomalies. (4.4)

5. *Labeling*
   - E1C does not have a labeling strategy at this time and will need to discuss this further with the EAC. (5.1 & 5.2)

Audit Recommendations

In consideration of the findings outlined in this audit report, the EAC recommends E1C take the following steps to improve overall quality management and quality assurance and to bring their current process more in line with the intention of the requirements of VVSG Section 8:

1. While formal ISO 9001 certification is not recommended at this time, the EAC does recommend that E1C develop a formalized organizational quality management system based on the principles of ISO 9001. Quality management is defined as all activities carried out by the organization to direct, control and coordinate quality. The activities should at a minimum include formulating a quality policy, internal quality audits and setting quality objectives. This recommendation can best be met by one or more E1C staff members receiving formal training in ISO 9001 concepts via one of the numerous commercial ISO training organizations.

2. Augment and fully implement the new organizational quality manual. The quality manual documents an organization's quality management system (QMS) and should:
   - Define the scope of the QMS.
     - Justify all exclusions (reductions in scope).
   - Describe how your QMS processes interact.

- Document your quality procedures.

3. Conduct regularly scheduled internal quality audits in order to monitor and measure your QMS, document any nonconforming procedures or products and perform corrective action to improve the nonconforming process or product.

4. Develop a systematic process for the review of new product design and design changes to already developed products. This process should include specific measurements to determine if design objectives are being met as well as a system of maintaining records of all design reviews.

5. Develop and implement detailed root cause analysis and nonconforming work procedures.

6. Determine the plans for labeling of the system through discussions with EAC prior to completion of the test campaign.

7. Develop a QA training program for internal employees. This program should focus on training employees on the procedures developed for the QMS, not the E1C product line.

8. Develop clear policies and procedures related to internal testing, being sure to address pass/fail criteria for all tests conducted, test case validation procedures and coverage of test cases.

9. The QA manager and staff should be a unit independent from other departments/units and should have the authority to halt products/components at any point in development, production and release of the product.

10. Identify a clear policy and procedures related to 3rd party testing.

11. Undergo another EAC quality assurance audit within one year of the date of this audit to allow the EAC to asses E1C's progress in meeting the recommendations of this audit.

Although the above recommendations are purely voluntary, the EAC strongly suggests that E1C implement the recommendations for the following reasons:

- ISO 9001 is the standard best practice specification for QMS in use worldwide. ISO 9001 has a track record of saving money, streamlining operations and reducing waste, and increasing customer satisfaction.
- As the EAC moves towards improving and truncating the certification process through the use of Manufacturer Declaration of Conformity (DoC), it is likely that ISO 9001 certification will eventually become a requirement for all EAC registered manufacturers in order to provide some additional assurance to the DoC and ultimately, to E1C customers.

The EAC requests that an initial written response to this report be submitted within 45 days of the date of this document.

Manufacturer Quality Audit

Everyone Counts

Date: 9/16/14 – 9/17/14

Reviewer:

Question	QA Reference	Evidence (Note any additional evidence or comments may be included in a supplementary notebook).	Yes, No, or NA
1	**Organizational Quality Management System**		
1.1	Does this organization operate under a corporate quality policy?		
1.2	Does a Quality Assurance unit (department) exist as a separate organizational entity?		
13	Does the Quality Assurance unit alone have both the authority and responsibility to approve or reject all designs, parts, components, and finished products?		
1.4	Does the QA department routinely review production records to ensure that procedures were followed and properly documented?		
1.5	Does the organization have a documented Quality Assurance program? (Quality Manual)		

Question	QA Reference	Evidence (Note any additional evidence or comments may be included in a supplementary notebook).	Yes, No, or NA
1.6	Does the Quality Manual contain (at minimum) • A quality policy statement, including objectives and commitments by executive management? • The reporting relationship between management, technical operations, production, support and the quality system? • The organizations general scope of product inspection and testing? • Appropriate and clear reference to inspection verification and test procedures to be used? • Reference to any procedures for inspection, calibration and maintenance of test equipment? • Procedures for handling non-conforming materials and products? •		
1.7	Does the Quality Manual provide means for finished products to be traced back to the production and quality control records at the manufacturing facilities?		

Question	QA Reference	Evidence (Note any additional evidence or comments may be included in a supplementary notebook).	Yes, No, or NA
1.8	Is the Quality Manual reviewed and/or revised at planned intervals?		
1.9	Has the organization implemented and maintained document and data control procedures for the Quality Manual/Quality System?		
1.10	Are the procedures followed? (Examine records to ensure consistent record-keeping and documentation.)		
1.11	Are QA supervisory personnel qualified by way of training and experience?		
1.12	Is a copy of the Quality Manual readily available to all employees?		
1.13	Is training provided in Quality Assurance and quality improvement?		
1.14	If "yes" to above, when provided? _____		
1.15	Does a formal auditing function exist in the Quality Assurance department?		
2	**Product Design and Development**		

Question	QA Reference	Evidence (Note any additional evidence or comments may be included in a supplementary notebook).	Yes, No, or NA
2.1	Do reviews occur at planned stages throughout the design process?		
2.2	Are reviews carried out in a systematic way involving representatives of all organizational functions concerned with the product development?		
2.3	When designs change from the original concept, are revised inputs and outputs reviewed and approved by the appropriate authorized individuals?		
2.4	Does the output demonstrate the suitability and conformance to specifications of the designed product?		
2.5	How is it determined if design objectives are being achieved?		
2.6	Are adequate records of design reviews maintained?		
3	**Pre-Production Design and Development Testing**		

Question	QA Reference	Evidence (Note any additional evidence or comments may be included in a supplementary notebook).	Yes, No, or NA
3.1	Is design and development testing done to validate that the product complies with the organizations own performance requirements and the requirements of customers and regulators (Federal and State certification authorities)?		
3.2	Are test methods traceable to pertinent system functional requirements and applicable Federal or State certification requirements?		
3.3	Are test records/reports maintained and do they confirm that appropriate testing has been carried out?		

Question	QA Reference	Evidence (Note any additional evidence or comments may be included in a supplementary notebook).	Yes, No, or NA
3.4	Do test records/reports include all information necessary for the reliable interpretation of test results? This information should include at minimum: • Descriptive title • Description and clear identification of the product being tested. • Date of test. • Identification of the test method used. • Clear and unambiguous description of the results of the test (Pass/Fail). • Signature and title of individual accepting responsibility for the content of the record/report.		
3.5	Do the records for each test contain sufficient information to permit repetition?		

Question	QA Reference	Evidence (Note any additional evidence or comments may be included in a supplementary notebook).	Yes, No, or NA
3.6	If test records/reports are performed and compiled by a contractor, that contractor must be audited by the manufacturer to ensure that the contractor is qualified to perform the testing contracted for (Including having appropriate accreditation) and meets the manufacturer's quality requirements.		
3.7	Manufacturer shall maintain and retain all records of contracted tests.		
4	**Identify and Control of Nonconforming Products**		
4.1	Does the organization define procedures used to identify, evaluate, and address any nonconforming product detected by inspection, customer report/complaint or Federal or State certification authority determination?		
4.2	Are corrective actions in place to explore the root cause of the nonconformance and provide a plan for eliminating the root cause?		
4.3	Is Information related to occurrences of nonconforming work recorded and maintained?		

Question	QA Reference	Evidence (Note any additional evidence or comments may be included in a supplementary notebook).	Yes, No, or NA
4.4	How are customers notified of nonconforming products and product upgrades resulting from root cause analysis and product redesign?		
5	Labeling		
5.1	What are the organizational policies on labeling (both marks of certification and other required labels such as URL)?		
5.2	How and when is correct labeling verified?		